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Monthly Engineering Report No. 13

Improvement of Wide-Band FM Radar

Detection Techniques

Period Covered: 1 October to 31 October 1961



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General Comments

This report covers the thirteenth period of contract activity for the improvement of FM radar detection techniques.

The job has been staffed by one full-time senior engineer, and one full-time engineer. Formal approval of the evaluation proposal has not yet been received. The contractor's representative, however, has informally assured approval, and work has proceeded.

Activities of the Report Period

Final testing of the system was completed toward the end of the previous report period, and the system was set up for evaluation. The system configuration selected first included the aerodynamic frequency translation technique, and the single, horizontally-polarized antenna feed. A set of target test patterns was constructed to aid in determining the limits of system resolution and sensitivity, and these same patterns will be used to evaluate each of the several system configurations. These patterns are placed in or behind various selected wall sections, and the area is "mapped". The wall materials used include masonite, brick, plasterboard, and plywood. Photographs were made of the resulting displays, and these were catalogued and evaluated. The photographs serve two purposes: they will serve as a basis for comparison of performance of this system configuration with other configurations, and they will ultimately provide data for construction of a chart which, for each of the several types of wall sections, will indicate the character of targets which can be detected.

The sensitivity pattern mentioned above is composed of a group of reflective squares ranging in size from 1/8-inch to 2 inches on a side. When the pattern is placed at the target focus, squares as small as 1/4-inch can be detected in air. The minimum sized square which can be detected when

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located immediately behind typical wall materials is indicated below:

Brick (no mortar)	2-inch
Plywood (3/4-inch)	1-inch
Sheetrock (3/8-inch)	1/2-inch
Masonite	1/4-inch

The reduction in sensitivity when operating into brick or plywood is the result of "clutter" arising from the non-homogeneous character of the cross-section of these materials. Squares are among the most difficult targets to locate; the detection of strips, tapers, columns, and the like is much simpler.

Another area of investigation was to determine the influence of target orientation (target plane not perpendicular to the antenna beam) upon system performance. Accordingly, a target pattern composed of equal-sized targets arranged at different angles relative to the antenna beam was mapped. Indications are that for target angles greater than about 20° off perpendicular most of the reflected rays will miss the antenna reflector, and thereby degrade system performance. Indirect detection of such a target is possible provided some reflective surface is located close behind the target. Under these conditions the r.f. "shadow" of the target can be detected, thereby indicating the presence of the target itself.

Program for the Ensuing Month

The evaluation along the lines described above will continue through the next report period. Other configurations will be evaluated with the objective of selecting the simplest configuration consistent with satisfactory performance. It is anticipated the evaluation of these other configurations will progress more rapidly because a reference for comparison has been established.

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